

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of

Redevelopment of Spectrum to
Encourage Innovation in the
Use of New Telecommunications
Technologies

ET Docket No. 92-9

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COMMENTS OF NORTHERN TELECOM

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December 11, 1992

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Summary

Northern Telecom supports the Commission's efforts to make spectrum available for new services such as PCS, and believes that as part of that effort the Commission can and should develop a plan for an orderly migration of fixed microwave users from the 2 GHz band. In doing so, however, the Commission must not jeopardize the benefits, including spectral efficiency, that are provided by high capacity wide bandwidth systems operating in the spectrum to which the 2 GHz licensees would relocate.

Northern Telecom strongly urges the Commission to retain the 3.7 to 4.2 GHz and 5.925 to 6.425 GHz bands exclusively for high capacity, high spectrally efficient usage. Specifically, the Commission should not allow wideband and narrowband channels to coexist in the 3.7 to 4.2 GHz and the 5.925 to 6.245 GHz bands. Mixing the two types of systems in the same bands, while making it extremely difficult to coordinate, will degrade the service and block the expansion capabilities of the highly efficient wide bandwidth systems, thereby wasting valuable spectrum.

Northern Telecom's comments set forth an alternative channelization plan that would accommodate the relocated licensees, while also ensuring that wideband channels were available for deployment and growth of the high capacity systems. The existing highly efficient wide bandwidth systems in the 4 GHz, 6 GHz and 11 GHz bands have well served the public interest by, inter alia, making possible long-distance competition.

Moreover, these highly efficient radio systems will continue to serve as an important part of the switched broadband telecommunications infrastructure in the future. Thus, the Commission should adopt the channelization scheme proposed by Northern Telecom in these comments.

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ET Docket No. 92-9

COMMENTS OF NORTHERN TELECOM

Northern Telecom Inc. ("Northern Telecom") hereby comments on certain issues raised in this Further Notice of Proposed Rule Making addressing the necessary changes to other bands to be used by relocated point-to-point users to allow the allocation of a block of spectrum in the 2 GHz band for new, spectrum dependent services.^{1/} Northern Telecom believes it is important for the Commission to make spectrum available for new services such as personal communications services (PCS), and had previously filed comments on the proposal of Alcatel Network Systems, Inc. ("Alcatel") suggesting an alternative channelization plan for the bands above 3 GHz.^{2/} Northern

1/ Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies, ET Docket No. 92-9, RM-7981, RM-8004, FCC 92-357, released September 4, 1992 (hereafter "Further Notice").

2/ Reply Comments of Northern Telecom in RM-8004, August 5, 1992, resubmitted in this proceeding October 1, 1992.

Telecom agrees that the Commission should develop an orderly method for migrating the current 2 GHz users into other bands so as to free up spectrum, rather than simply relying on a blanket waiver of the eligibility requirements. In doing so, however, the rechannelization must not impact adversely the operation and expansion capabilities of high capacity spectral efficient microwave systems operating in the bands to which the 2 GHz licensees would move.

Background

Northern Telecom is a world leader in manufacturing telecommunications equipment, and is well qualified to address the issues raised in the Further Notice. Northern Telecom is the leading global supplier, in 90 countries, of digital telecommunications switching systems, providing products and services to the telephone operating companies, governments, and other institutions worldwide. Northern Telecom has some 60,000 employees, and had revenues in 1991 of \$8.2 billion.

Northern Telecom believes that fixed microwave radio will continue to play an important role in switched broadband networks, even as fiber is more widely deployed, and that radio products compatible with Synchronous Optical Network ("SONET") products must be capable of operating in a seamless fashion with SONET fiber systems. Northern Telecom is investing heavily in research and development to continue introducing advanced technologies that increase spectral efficiency to fulfill the

requirements of today's and future communications networks. In particular, Northern Telecom is a major supplier of advanced fixed microwave equipment, and pioneered spectrally-efficient high capacity microwave equipment. Northern Telecom was the first manufacturer to commercialize 64 Quadrature Amplitude Modulation ("QAM") technology in 1983 in response to the needs of the then nascent competitive long distance industry. There are now over 17,000 radio units deployed utilizing this technology. The 64 QAM technology developed by Northern Telecom allows a spectral efficiency rate of 5 bits/sec/Hz, and provides capacity of two or three DS3's per 20 MHz or 30 MHz radio channel (equivalent to 1344 or 2016 voice channels).

Northern Telecom has continued to increase the efficiency of its microwave equipment, and has introduced 512 QAM technology. These recent advances result in a spectral efficiency of 8 bits/sec/Hz, reflecting a 60% increase in efficiency when compared to the previous generation of highly efficient equipment. Northern Telecom's 512 QAM technology allows the capacity of six DS3's/STS-1's to be carried per 40 MHz radio channel, which is equivalent to 4032 voice channels.

This new technology was introduced as part of Northern Telecom's FiberWorld, which integrates fiber optic and microwave-based SONET transmission and switching equipment.^{3/} The

^{3/} FiberWorld is a Northern Telecom product family that consolidates the economic and performance benefits of fiber transport into a total integrated strategy, delivering an end-to-end portfolio of products rigorously designed to open, public standards such as SONET and TR-403. Through the synergy of fiber
(continued...)

continued availability of spectrum for high-capacity microwave links is a necessary element of a robust telecommunications infrastructure that can support the Information Age. Therefore, the Commission should not adopt a migration plan that jeopardizes the high-density microwave routes presently operating in the 4 GHz, 6 GHz and 11 GHz bands.

The Commission Should Adopt a Relocation
Scheme That Does Not Hamper Deployment
and Growth of High Capacity Systems

Frequency Sharing and Channelization

In order that the Commission's goal of making 2 GHz spectrum available for emerging technologies not jeopardize the efficiencies and related benefits that result from these high-capacity microwave links, Northern Telecom makes several recommendations as follows.

First, Northern Telecom strongly urges the Commission to retain the 3.7 to 4.2 GHz and 5.925 to 6.425 GHz bands exclusively for high capacity, high spectrally efficient usage. Specifically, the Commission should not allow wideband and narrowband channels to coexist in the 3.7 to 4.2 GHz and the 5.925 to 6.425 GHz bands.

3/(...continued)
optic access and transport technology with broadband switching, FiberWorld unleashes the power of the fiber network with full multivendor interworking and compatibility. In addition, through its 512 QAM technology, Northern Telecom has integrated broadband radio products into the FiberWorld family, thereby making available a comprehensive switched broadband network.

Such mixed usage of wideband and narrowband channels in this spectrum, while making it extremely difficult to coordinate, will tend to block development or expansion of the high capacity wideband systems in the bands, with a resulting negative impact on spectral efficiency. To the extent that there is a perceived need to allow both types of facilities in a single band, sharing the 10.7 to 11.7 GHz bands for wideband and narrowband channels is a preferable alternative.^{4/} Due to the wide range of spectrum (1 GHz) available in this band, it has the best potential to accommodate both wide and narrow bandwidth applications.^{5/}

Northern Telecom proposes the standardization of 10 MHz, 30 MHz and 40 MHz wide channels that can be coordinated with the current 40 MHz plan; two of the 40 MHz channel pairs should be shared with narrowband applications, using 10 MHz, 5 MHz, 3.75 MHz, 2.5 MHz and 1.25 MHz channels.

In addition, to maximize efficiency, there is another technical issue the Commission should address. Northern Telecom suggests the standardization of 40 MHz channels in the 3.7 to 4.2 GHz band. A 40 MHz channel plan can be derived from and

4/ Should the Commission determine that it may be necessary to permit some sharing of narrowband and wideband channels in the 3.7 to 4.2 GHz and/or 5.925 to 6.425 GHz bands, then the rules should require that licensing of narrowband channels in the 3.7 to 4.2 GHz and 5.925 to 6.2425 GHz bands should occur only upon providing proof that coordination at 10.55 to 10.68 GHz, 10.7 to 11.7 GHz and 6.525 to 6.875 GHz bands does not allow the narrowband system to operate in those preferable bands.

5/ In light of the potential amount of spectrum available in the 11.7 to 12.2 GHz and 12.7 to 13.25 GHz bands, Northern Telecom suggests that an industry wide committee be formed to propose adequate channelizations.

coordinated with the existing 20 MHz channelization plan. The use of 40 MHz wide channels provides a significant advantage since high capacity radio with better than 8 bits per second per Hertz spectral efficiency is now available (i.e., 6xDS-3/STS-1 or 4,032 VF channel loading).

In the 5.925 to 6.425 GHz band, Northern Telecom recommends the continuing support of the existing 29.65 MHz channels. Northern Telecom also proposes the standardization of 40 MHz wideband channels in that band, to permit the operation of very high capacity radios for typical common carrier multi-channel usage.

Other issues raised by the Commission

In addition to proposing an alternative channelization scheme that considers the need to allow for deployment and expansion of wideband channels, Northern Telecom has some comments on specific questions raised in the Further Notice.

Recognizing that the sharing of the 3.7 to 4.2 GHz and the 5.925 to 6.425 GHz spectrum by wideband and narrowband users would be very difficult to coordinate, Northern Telecom supports the Commission's proposal to approach the NTIA to open formal discussions to determine whether some form of shared access to the 1.71 to 1.85 GHz and 3.6 to 3.7 GHz bands by common carriers and private operating fixed microwave users can be achieved.^{6/}

6/ Further Notice at para. 20.

Northern Telecom agrees with the Commission's proposal to utilize current coordination procedures incorporated in Part 21 and Part 94 to govern the common carrier and private carrier usage, respectively.^{7/} With respect to those Rules, Northern Telecom generally supports the current procedures for reservation of channel growth for the Part 21 wideband channel users. Those procedures achieve economic advantages from starting with a small number of radio channels and growing over time to meet the need for higher capacity. However, Northern Telecom does not believe that it is necessary to reserve for growth channels with less than 20 MHz bandwidth, because it would be more efficient when added capacity is needed to install a wideband channel in place of 1+ N narrowband channels.

The Further Notice also seeks comment on standards to account for the growing use of digital equipment. Northern Telecom supports the adoption of the following new digital standards, while maintaining existing voice channel loading requirements and analog standards to minimize disruption of existing microwave radio systems. Also, a five year transition period after adoption of final rules should be allowed in order to minimize disruption.

7/ Further Notice at para. 30.

Nominal Channel Bandwidth (MHz)	Minimum Payload Capacity (Mbts/s)	Minimum Traffic Loading Payload (as percent of payload capacity)	Typical Utilization
1.25	3	n/a	2 DS-1
2.5	6	n/a	4 DS-1
3.75	12	n/a	8 DS-1
5.0	18	n/a	12 DS-1
10.0	44	50	1 DS-3/STS-1
20.0	89	50	2 DS-3/STS-1
30.0	134	50	3 DS-3/STS-1
40.0	178	50	4 DS-3/STS-1

For all bands, concatenation of multiple contiguous channels should be permitted as long as the minimum payload capacity requirements are met.

Northern Telecom also fully supports the Commission's suggestion that the expansion of existing microwave systems should be allowed under current channelization plans without waiver.^{8/} In addition, Northern Telecom agrees that the automatic transmit power control (ATPC) technique should be explicitly authorized in Part 21 and Part 94 of the FCC rules, and Northern Telecom supports the proposed changes.^{9/} Finally, with regard to the power mask rules, Northern Telecom urges continued use of the existing FCC mask under Part 21 and Part 94.^{10/}

8/ Further Notice at para. 32.

9/ Further Notice at para. 33.

10/ Further Notice at para. 33.

Alternative Channelization Scheme

As discussed above, Northern Telecom believes that it is important that any rechannelization plan fully consider the need for the continued deployment and growth of high capacity wide bandwidth systems in order to preserve the efficiency those systems provide. Thus, as an alternative to the proposal set forth in the Further Notice, Northern Telecom advocates adoption of the following requirements and channelization plan.

Northern Telecom urges the Commission to adopt a "two frequency" plan for operation of narrowband channels in common carrier and private operating fix bands between 3 and 11 GHz, which should allow twice the number of users in the same bandwidth as compared to a "four frequency" plan.^{11/} Northern Telecom proposes that in those bands, new users, as well as existing users converting from analog to digital or expanding their system, should be required to use a two frequency plan to make more spectrum available. Such a requirement would make available adequate capacity using the alternative channelization plan proposed by Northern Telecom to allow the migration of users from the 2 GHz band without jeopardizing the benefits of high capacity wide bandwidth systems.

^{11/} A two frequency plan assigns two frequencies per user, whereas a four frequency plan assigns four frequencies per user. The use of ATPC technology permits a two frequency plan, while also relaxing requirements on antenna systems. A two frequency plan utilizes half as much spectrum, or allows twice the number of users in the same bandwidth, thus enhancing efficiency and making coordination easier.

Channelization Proposals

First, Northern Telecom proposes to modify the Commission's proposed rules governing the 3.7 to 4.2 GHz band.^{12/} Northern Telecom recommends a 40 MHz maximum authorized bandwidth, along with a 40 MHz separation between transmit/receive channel pairs. In this band, Northern Telecom also opposes channel plans below 20 MHz bandwidth (i.e., 400 KHz, 800 KHz, 1.6 MHz, 5 MHz and 10 MHz). Northern Telecom recommends that the existing 20 MHz interleaved channelization plan be retained, and opposes the newly proposed split band frequency pairing. In other words, the transmit/receive 20 MHz channels should be paired as follows:

^{12/} Further Notice proposed Sections 21.701(d) and 94.65(g).

3,700 to 4,200 MHz 20 MHz Bandwidth Channels			
	<u>Transmit</u> <u>(Receive)</u>		<u>Receive</u> <u>(Transmit)</u>
1	3710	.....	3750
2	3730	.....	3770
3	3790	.....	3830
4	3810	.....	3850
5	3870	.....	3910
6	3890	.....	3930
7	3950	.....	3990
8	3970	.....	4010
9	4030	.....	4070
10	4050	.....	4090
11	4110	.....	4150
12	4130	.....	4170
13	4190 (unpaired channel)		

Northern Telecom also recommends the addition of a 40 MHz channelization plan derived from the existing 20 MHz plan as follows:

3,700 to 4,200 MHz 40 MHz Bandwidth Channels			
	<u>Transmit</u> <u>(Receive)</u>		<u>Receive</u> <u>(Transmit)</u>
1	3720	.....	3760
2	3800	.....	3840
3	3880	.....	3920
4	3960	.....	4000
5	4040	.....	4080
6	4120	.....	4160

Northern Telecom additionally urges the Commission to modify the proposed rules governing the 5.925 to 6.425 GHz band.^{13/} In this band, Northern Telecom recommends a 40 MHz maximum authorized bandwidth, with a 250 MHz separation. Northern Telecom opposes the channelizations of 20 MHz or narrower (proposed subsections (1) through (6)), and recommends instead continuing usage of the existing 29.65 MHz channels for this band. Northern Telecom proposes the addition of 40 MHz bandwidth channels for this band, as follows:

5,925 to 6,425 MHz 40 MHz Bandwidth Channels			
	<u>Transmit</u> <u>(Receive)</u>		<u>Receive</u> <u>(Transmit)</u>
1	5950	.....	6200
2	5990	.....	6240
3	6030	.....	6280
4	6070	.....	6320
5	6110	.....	6360
6	6150	.....	6400

Northern Telecom recommends that the 6.525 to 6.875 GHz and 10.55 to 10.68 GHz bands be reserved for narrow bandwidth channel applications.^{14/} Recommended narrow channel bandwidths are as follows: 1.25 MHz, 2.5 MHz, 3.75 MHz, 5.0 MHz and 10 MHz (the latter applies only to the 6.525 to 6.875 GHz band).

13/ Further Notice proposed Sections 21.701(e) and 94.65(h).

14/ Further Notice proposed §§ 21.701(f) & (g) and §§ 94.63(i) & (j).

With respect to the Further Notice table of emission and bandwidth limitations applicable to Part 94.71(b) and Part 21.703(a), Northern Telecom proposes the following modifications to the maximum authorized bandwidth for the 4, 6 and 11 GHz bands.

<u>Frequency Band (MHz)</u>	<u>Maximum authorized bandwidth (MHz)</u>		
	<u>Current</u>	<u>Further Notice</u>	<u>NT proposal</u>
3,700 to 4,200	20	20	40
5,975 to 6,425	30	30	40
10,700 to 11,700	40	30	40

Finally, with respect to the Further Notice proposed Section 21.701(h) and Section 94.65(k), Northern Telecom recommends the continuing support of the existing 40 MHz maximum authorized bandwidth, with a 530 MHz separation. Northern Telecom opposes the 10 and 30 MHz center channel frequencies set forth in subsections (1) and (2) proposed in the Further Notice, and suggests instead the following channelization plans in the 10.7 to 11.7 GHz frequency band^{15/}:

^{15/} It should be noted that the 10 MHz and 30 MHz channel plans proposed by Northern Telecom are staggered side-by-side, alleviating mixed usage coordination issues.

10,700-11,700 MHz, 40.0 MHz bandwidth channels			
	Transmit (receive) (MHz)		Receive (transmit) MHz)
1	10735	.....	11265
2	10775	.....	11305
3	10815	.....	11345
4	10855	.....	11385
5	10895	.....	11425
6	10935	.....	11465
7	10975	.....	11505
8	11015	.....	11545
9	11055	.....	11585
10	11095 ¹	.....	11625 ¹
11	11135 ¹	.....	11685 ¹
¹ Alternate channels. These channels are set aside for narrow bandwidth systems and should be used only if all other channels are blocked.			

10,700-11,700 MHz, 30.0 MHz bandwidth channels			
	Transmit (receive) (MHz)		Receive (transmit) MHz)
1	10717	.....	11245
2	10755	.....	11285
3	10795	.....	11325
4	10835	.....	11365
5	10875	.....	11405
6	10915	.....	11445
7	10955	.....	11485
8	10995	.....	11525
9	11035	.....	11565
10	11075 ¹	.....	11605 ¹
11	11115 ¹	.....	11645 ¹
12	11155 ¹	.....	11685 ¹
¹ Alternate channels. These channels are set aside for narrow bandwidth systems and should be used only if all other channels are blocked. Only half of channels 10 (the upper portion) can be used for narrow band applications.			

10,700-11,700 MHz, 10.0 MHz bandwidth channels			
	Transmit (receive) (MHz)		Receive (transmit) (MHz)
1	10735	.....	11265
2	10775	.....	11305
3	10815	.....	11345
4	10855	.....	11385
5	10895	.....	11425
6	10935	.....	11465
7	10975	.....	11505
8	11015	.....	11545
9	11055	.....	11585
10	11095 ¹	.....	11625 ¹
11	11135 ¹	.....	11685 ¹
¹ Alternate channels. These channels are set aside for narrow bandwidth systems and should be used only if all other channels are blocked.			

CONCLUSION

Northern Telecom supports the Commission's efforts to make spectrum available for new services, and believes that as part of that effort the Commission can and should develop a plan for an orderly migration of fixed microwave users from the 2 GHz band. Northern Telecom's comments set forth an alternative channelization plan that restricts the opportunity for narrow bandwidth systems to operate in the same frequencies as wide bandwidth systems. Mixing the two types of systems in the same bands will degrade the service and block the expansion capabilities of the highly efficient wide bandwidth systems, thereby wasting valuable spectrum.

The existing highly efficient wide bandwidth systems in the 4 GHz, 6 GHz and 11 GHz bands have well served the public interest by, inter alia, making possible long-distance competition. Moreover, these highly efficient radio systems will continue to serve as an important part of the switched broadband telecommunications infrastructure in the future. Thus, the Commission should not adopt a plan for the migration of narrowband 2 GHz systems that could impair these wide bandwidth systems, and the proposals in the Further Notice should be modified as suggested herein to maintain distinct allocations for narrow bandwidth and wide bandwidth systems.

Respectfully submitted,

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